ENHANCED FUMIGATION EFFICACY AS A METHYL BROMIDE ALTERNATIVE: CASE STUDIES WITH SULFURYL FLUORIDE

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Food processing plants (FPP) may be fumigated one or more times per year to help manage infestations of various stored-product insect pests. Both methyl bromide and phosphine are used currently, although methyl bromide is generally favored due to its shorter exposure times and to its greater safety to electronic equipment. Interest in the use of sulfuryl fluoride (a widely-used structural fumigant for termites and other wood-destroying insects for over 30 years) as an alternative to current fumigants has lead to a number of FPP field trials to confirm stored-product insect pest (SPIP) efficacy and to develop necessary labeling.

A challenge to all FPP fumigations is to sufficiently retain the gas throughout the fumigated structure in order to achieve adequate SPIP control. To address this question with sulfuryl fluoride, six fumigations with sulfuryl fluoride of FPP buildings were conducted in California in May and July of 1997, 1998 and 1999. Measurements of gas concentrations, gas retention, temperature, and insect mortality within prepared SPIP bioassays were collected and compared relative to building structural design and sealing techniques.

A standard tape vs. tarp-seal was compared using a single-floor, 22,937 m^3 metal warehouse fumigated during two consecutive July 4 weekends in 1997 and 1998. The tarp-seal resulted in nearly an 8-fold increase in gas retention, measured as half-loss time (HLT), from approximately 9 h for the tape-seal to approximately 66 h for the tarp-seal. The tarp-seal allowed for approximately a 36% decrease in fumigant used while resulting in a 67% increase in the CT dosage. This significant savings in fumigant should be considered when evaluating the economic savings of tarp vs. tape-seal the building.

Another two-floor, 14,583 m^3 concrete and metal mill was fumigated during two consecutive Memorial Day weekends in 1998 and 1999 comparing standard tape-seal vs. enhanced tape plus foam-sealing techniques. Use of foam sealants along with tape to seal all observed possible gas escape routes increased gas retention by about 1.5-fold, from about 9-h to 14-h HLT. Use of ventilation ducts to direct air movement in situations of poor cross-ventilation during the second fumigation both speeded up and maintained an equilibrium throughout the exposure period.

A third four-floor, 8,495 m^3 concrete mill and a fourth single-floor, 12,105 m^3 concrete processing plant were tape-sealed and fumigated on consecutive July 4 weekends in 1998 and 1999. HLT values were about 22 h and 17 h, respectively.

Results from these six fumigation field trials confirmed many expectations, suggesting that:

- Sulfuryl fluoride is an effective alternative to methyl bromide for 24-48 h fumigations for stored-product insect pests in food processing plants;
- Sulfuryl fluoride can be introduced into the structure, achieve equilibrium within 2 hours, and maintain equilibrium throughout the exposure period, even in buildings with poor internal air circulation;
- Newer, concrete buildings retain gas better than older concrete or metal buildings;
- Thorough tape plus foam-sealing can enhance gas retention over tape-sealing alone;
- Tarp-sealing greatly enhances gas retention over tape-sealing and may compensate for the added labor costs to tarp-seal;
- Gas retention using standard sealing techniques and effort may be less than 10-hr HLT in many food processing buildings, and may be up to 20-h HLT in the better-constructed buildings.